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GB 1365107

GB 1460034

(58) Field of search

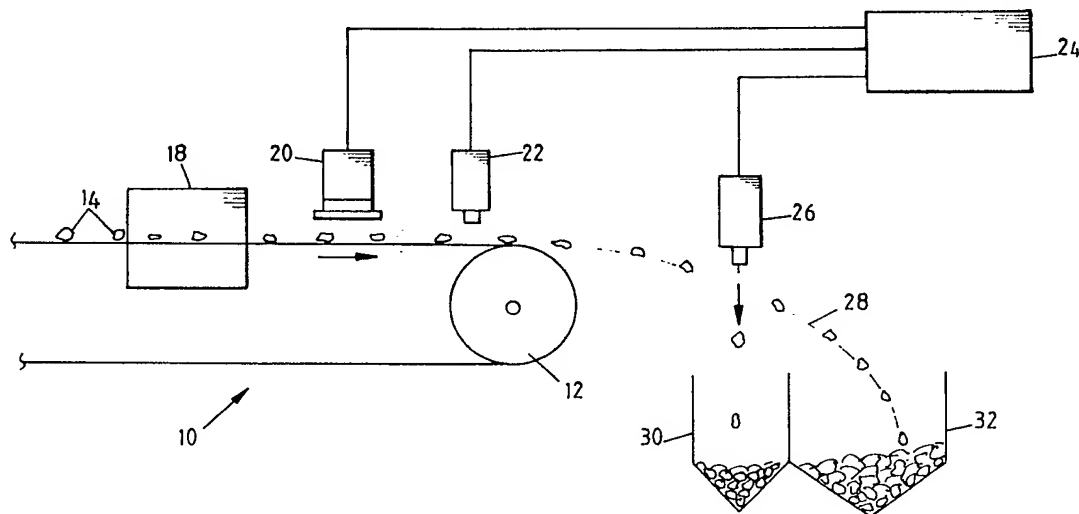
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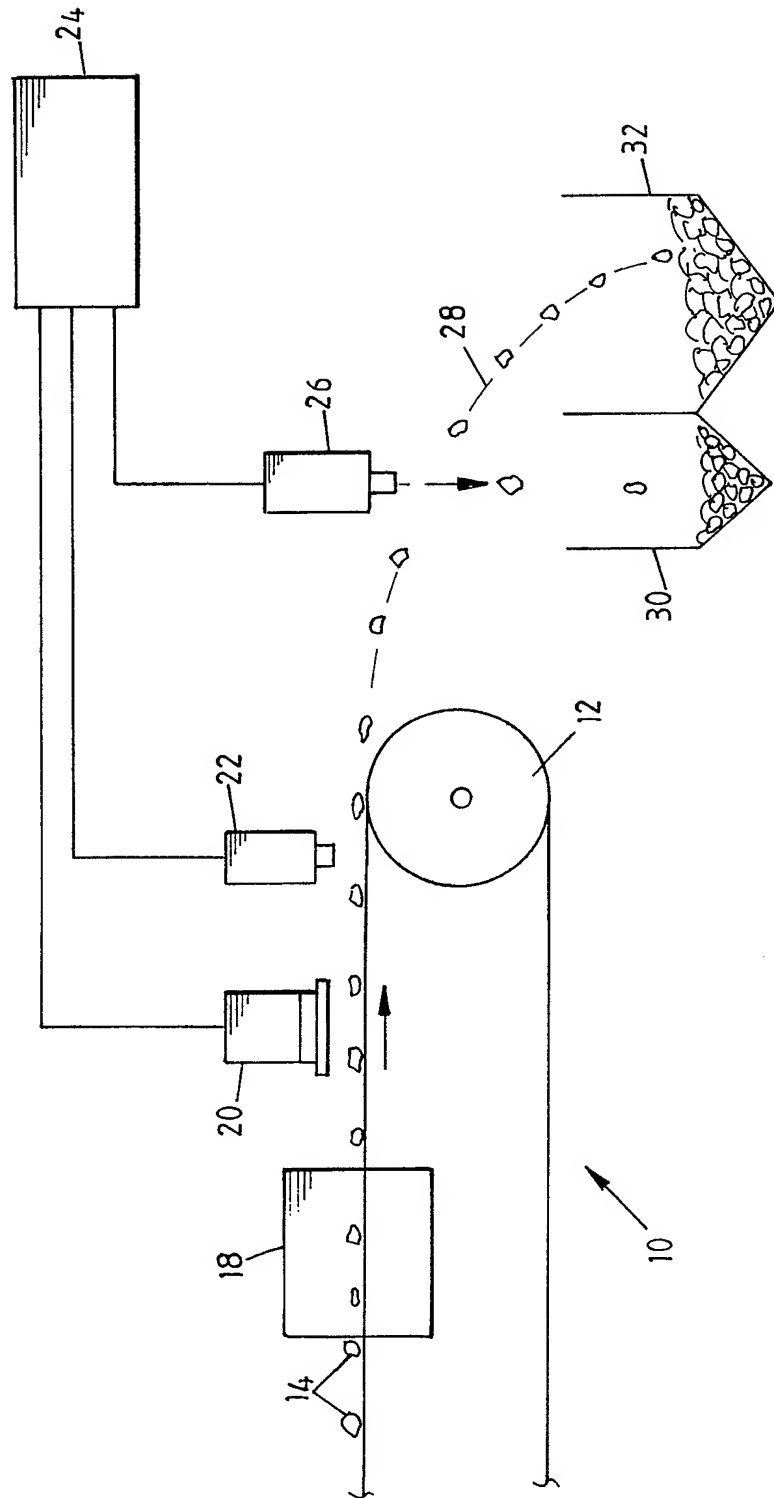
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G01N

(54) **Sorting ore particles**

(57) Ore particles (14) are sorted by subjecting them to electromagnetic radiation in the microwave part of the spectrum, e.g. by passing through chamber (18), the frequency of the radiation being at the resonant frequency of water or that of one or more target minerals or possibly a combination of such frequencies. The resultant heat emission characteristics of the particles are detected by e.g. infra-red detector (20) and analysed at (24). Particles exhibiting a desired heat emission characteristic are separated at (26) from other particles which do not exhibit such characteristic. In one application of the method, kimberlite particles can be separated from non-kimberlitic particles, typically gabbro. This is achieved by subjecting the particles to electromagnetic radiation at a frequency of about 2450MHz, this being a resonant frequency for water, it being known that kimberlite has a higher water content than gabbro. Line scan camera 22 provides signals indicative of the size of the particles which are fed to processor (24).





SPECIFICATION

Sorting method and apparatus

5 BACKGROUND TO THE INVENTION

THIS invention relates to a sorting method and apparatus.

All rock types are composed of an aggregate of minerals of a certain composition in a certain proportion to one another. All rock types also contain a certain volume of water which is inherent, bound up in the form of waters of crystallisation, pore water or surface water. The different minerals in the rock will each have a different excitation characteristic when subjected to microwave radiation.

At Premier Mine in the Republic of South Africa, a sill of gabbro in the diamond pipe, which contains diamond-bearing kimberlitic ores, has resulted in dilution of the kimberlite with gabbro and difficulties in sorting the desired kimberlitic ores from the unwanted gabbro. In this particular case, it is known that kimberlite has a higher water content than does gabbro or other non-kimberlitic ones, such as felsite, which are encountered.

The present invention seeks to provide a sorting method and apparatus which relies on different responses to microwave irradiation and, in one embodiment, to provide a method and apparatus for use in sorting kimberlitic ores from non-kimberlitic ores.

SUMMARY OF THE INVENTION

The invention provides a method of sorting a mass of ore particles into desired and undesired fractions, the method including the steps of irradiating the particles with electromagnetic radiation in the microwave part of the spectrum and at a frequency which is the frequency corresponding to a strong absorption peak of a target mineral or of water, or at different frequencies being the frequencies corresponding to strong absorption peaks of one or more target minerals and water, so that the target mineral(s) or water or both, if present, are heated up, detecting and analysing the heat emission of the particles, and sorting particles having a selected heat emission characteristic from other particles with different heat emission characteristics.

Typically the heat emission characteristic of the particles may be detected with infra-red detectors, heat detectors or using thermal imaging techniques.

In one particular application of the invention, the above method can be used to sort kimberlitic ores from non-kimberlitic ores, such as gabbro and felsite. In this case, the microwave irradiation has a frequency which is the resonant frequency of water, typically of the order of 2450MHz.

The invention also provides apparatus for carrying out the above method, the apparatus including a microwave chamber in which par-

ticles are subjected to microwave radiation at a selected frequency being the frequency corresponding to a strong absorption peak of a target mineral or water or at different selected frequencies being the frequencies corresponding to strong absorption peaks of one or more target minerals and water, means for detecting the heat emissions of the particles after their irradiation, means for analysing the heat emissions and means for separating desired particles having a selected heat emission characteristic from other particles with different heat emission characteristics on the basis of the analysis.

BRIEF DESCRIPTION OF THE DRAWINGS

The sole Figure shows a schematic illustration of an apparatus according to the invention.

DESCRIPTION OF AN EMBODIMENT

In the embodiment described below, the method and apparatus of the invention are used to sort particles of desired kimberlite ore from particles of undesired, non-kimberlitic ores, such as gabbro and felsite.

Referring to the drawing, the numeral 10 indicates a conveyor belt which passes over a head pulley 12 and which carries ore particles 14 which are to be sorted on its upper run 16. The belt passes through a microwave chamber 18 in which the particles are subjected to microwave radiation at a frequency of 2450MHz which is the frequency at which water exhibits a strong absorption peak. On emerging from the chamber after a preselected residence time, those particles of kimberlite will have a higher temperature than non-kimberlitic particles, such as gabbro and felsite. This is because the kimberlite particles have a higher water content which is excited by the microwave radiation, leading to greater internal heating.

The heat emission characteristics of the particles are detected, in this case with the use of an infra-red detector 20 which detects the infra-red radiation emitted by the particles. A line scan camera 22 is also focussed on the particles, this camera serving providing signals indicative of the size of the particles. Larger particles will heat up less quickly than will smaller particles.

Signals from the infra-red detector and from the line-scan camera are fed to a processor 24 which analyses the signals and which activates, at the appropriate moment, an air blast ejector 26 when the analysis of the signals indicate the presence of a particle having desired heat emission characteristics i.e. a kimberlite particle. The air blast ejector 26 moves the desired particle out of the stream of particles proceeding along the trajectory 28 and into a bin 30. The remaining, unselected particles continue unimpeded to the bin 32.

CLAIMS

1. A method of sorting a mass of ore particles into desired and undesired fractions, characterised in that it includes the steps of
5 irradiating the particles (14) with electromagnetic radiation in the microwave part of the spectrum and at a frequency which is the frequency corresponding to a strong absorption peak of a target mineral or of water, or at
10 different frequencies being the frequencies corresponding to strong absorption peaks of one or more target minerals and water, so that the target mineral(s) or water or both, if present, are heated up, detecting and analysing the
15 heat emission of the particles, and sorting particles having a selected heat transmission characteristic from other particles with different heat emission characteristics.
2. The method of Claim 1 characterized in
20 that the heat emission characteristics of the particles are detected with infra-red detectors (20), heat detectors or using thermal imaging techniques.
3. The method of either one of the preceding claims characterized in that water content
25 forms the basis for the sorting of the desired particles from the undesired particles and in that the particles are irradiated with electromagnetic radiation in the microwave part of the spectrum and at a frequency corresponding
30 to a strong absorption peak of water.
4. The method of Claim 3 characterized in that the frequency of the radiation is about 2450MHz.
- 35 5. The method of either one of Claims 3 or 4 characterized by its use to sort kimberlite particles from non-kimberlite particles.
6. An apparatus for use in the method of Claim 1 and characterized by including a microwave chamber in which particles are subjected to microwave radiation at a selected
40 frequency being the frequency corresponding to a strong absorption peak of a target mineral or water or at different selected frequencies being the frequencies corresponding to
45 strong absorption peaks of one or more target minerals and water, means for detecting the heat emissions of the particles after their irradiation, means for analysing the heat emissions and means for separating desired particles having a selected heat emission characteristic from other particles with different characteristics on the basis of the analysis.
- 50 7. Sorting apparatus substantially as hereinbefore described with reference to the accompanying Drawing.
- 55 8. Sorting method substantially as hereinbefore described with reference to the accompanying Drawing.